

SPECIFICATION

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DISHWASHER BOTTOM DOOR SEAL

Background of Invention

[0001] This invention relates generally to sealed door assemblies, and, more specifically, to a seal assembly for the bottom of a dishwasher door.

[0002] Known dishwasher systems include a cabinet, a tub within the cabinet that defines an open sided wash chamber, and a door assembly that seals the open side of the wash chamber when the dishwasher is in use. Soiled dishes, glasses, utensils, food and beverage containers, etc., are loaded into the dishwasher tub through the open side of the wash chamber when the door is open, and after the door is closed, a dishwasher cycle may be executed to clean the items placed therein. The wash chamber includes a sump portion where washing fluid is pumped from a fluid circulation assembly through spray arm conduits to wash items loaded onto dishwasher racks in the wash chamber, and also where wash fluid is collected after being circulated throughout the wash chamber. The door assembly is attached to the dishwasher at a bottom end of the door and pivots about a hinge between fully open and fully closed positions.

[0003] To properly seal the wash chamber when the door is closed, a number of sealing features are employed. For example, a number of rubber gaskets and other known sealing members are attached to the door and/or portions of the dishwasher wash chamber that receive an interior portion of the door assembly. In one type of dishwasher, a bottom door seal is attached to an inner panel of the door assembly to seal the lower region of the wash chamber in the vicinity of the tub sump portion where the door assembly is attached to the dishwasher. In some dishwashers, this is accomplished with a gasket that includes a number of ribs such that when the gasket

is press-fit into a channel at the bottom of the door assembly, the gasket is maintained in place with an interference fit due to compression of the gasket ribs.

- [0004] While this type of press-fit gasket assembly may form an adequate seal for the dishwasher door, the gasket can be difficult to properly place in the channel, thereby complicating assembly of the door and increasing assembly costs.

Summary of Invention

- [0005] In one aspect, a door panel assembly for a dishwasher is provided. The door assembly comprises a panel comprising a formation depending therefrom, and a seal member comprising a head portion and an opening therein complementary in shape to said formation, said formation received in said opening.

- [0006] In another aspect, a door panel assembly for a dishwasher is provided. The door panel assembly comprises an inner door panel comprising a formation extending therefrom, and a seal member comprising a head portion and an opening therethrough, said opening receiving said formation and attaching said seal member to said formation.

- [0007] In still another aspect, a door panel assembly is provided that comprises a panel comprising a bottom portion, a formation extending therefrom, and a barrier portion extending therefrom in a spaced apart relationship to said formation. A seal member comprises a head portion and a flap portion extending from said head portion, said head portion comprising an opening therethrough for receiving said formation, said head portion engaged to said formation.

- [0008] In yet another aspect, a door panel assembly is provided that comprises a door panel comprising a boot-shaped formation depending therefrom, and a seal member comprising a head portion comprising a boot-shaped opening therethrough, said boot-shaped opening fitted to said boot-shaped formation.

Brief Description of Drawings

- [0009] Figure 1 is a side elevational view of an exemplary dishwasher system partially broken away.

- [0010] Figure 2 is a perspective exploded view of a dishwasher door assembly for the dishwasher shown in Figure 1.
- [0011] Figure 3 is a rear plan view of an inner door panel assembly shown in Figure 2.
- [0012] Figure 4 is a cross sectional view of a portion of the inner door shown in Figure 3 along line A-A; Figure 5 is a cross sectional view of a portion of a seal member shown in Figure 3 along line A-A.
- [0013] Figure 5 is a cross sectional view of a portion of a seal member shown in Figure 3 along line A-A.
- [0014] Figure 6 is a cross sectional view of the door assembly shown in Figure 3 along line A-A.
- [0015] Figure 7 is a cross sectional schematic view of a portion of the dishwasher shown in Figure 1 with the inner door panel assembly shown in Figure 3 attached.

Detailed Description

- [0016] Figure 1 is a side elevational view of an exemplary domestic dishwasher system 100 partially broken away, and in which the present invention may be practiced. It is contemplated, however, that the invention may be practiced in other types of dishwashers and dishwasher systems beyond dishwasher system 100 described and illustrated herein. Moreover, the door construction described below may find utility and its benefits accrue to appliances generally. Accordingly, the following description is for illustrative purposes only, and the invention is in no way limited to use in a particular type of appliance, such as a particular dishwasher system, for example dishwasher system 100.
- [0017] Dishwasher 100 includes a cabinet 102 having a tub 104 therein and forming a wash chamber 106. Tub 104 includes a front opening (not shown in Figure 1) and a door assembly 120 hinged at its bottom 122 for movement between a normally closed vertical position (shown in Figure 1) wherein wash chamber 106 is sealed shut for washing operation, and a horizontal open position (not shown) for loading and unloading of dishwasher contents. Upper and lower guide rails 124, 126 are mounted on tub side walls 128 and accommodate upper and lower roller-equipped racks 130,

132, respectively. Each of upper and lower racks 130, 132 is fabricated from known materials into lattice structures including a plurality of elongate members 134, and each rack 130, 132 is adapted for movement between an extended loading position (not shown) in which the rack is substantially positioned outside wash chamber 106, and a retracted position (shown in Figure 1) in which the rack is located inside wash chamber 106. Conventionally, a silverware basket (not shown) is removably attached to lower rack 132 for placement of silverware, utensils, and the like that are too small to be accommodated by upper and lower racks 130, 132.

[0018] A control panel (not shown in Figure 1) is integrated into an escutcheon 136 that is mounted to door assembly 120, or in further and/or alternative embodiments control selectors, (e.g., buttons, switches or knobs) or control displays, etc. may be mounted at a convenient location on an outer face 138 of door assembly 120. The control panel and associated selectors and displays are coupled to known control circuitry (not shown) and control mechanisms (not shown) for operating a fluid circulation assembly (not shown) that circulates water and dishwasher fluid in dishwasher tub 104. The fluid circulation assembly is located in a machinery compartment 140 located below a bottom sump portion 142 of tub 104. The construction and operation of the fluid circulation assembly is believed to be beyond the scope of the present invention but well within the purview of those in the art without detailed explanation, and further discussion of the fluid circulation assembly is therefore omitted.

[0019] A lower spray-arm-assembly 144 is rotatably mounted within a lower region 146 of wash chamber 106 and above tub sump portion 142 so as to rotate in relatively close proximity to lower rack 132. A mid-level spray-arm assembly 148 is located in an upper region of wash chamber 106 and is located in close proximity to upper rack 130 and at a sufficient height above lower rack 132 to accommodate a largest item, such as a dish or platter (not shown), that is expected to be placed in lower rack 132 and washed in dishwasher system 100. In a further embodiment, an upper spray arm assembly (not shown) is located above upper rack 130 at a sufficient height to accommodate a tallest item expected to be placed in upper rack 130, such as a glass (not shown) of a selected height.

[0020] Lower and mid-level spray-arm assemblies 144, 148 and the upper spray arm assembly are fed by the fluid circulation assembly, and each spray-arm assembly includes an arrangement of discharge ports or orifices for directing washing liquid onto dishes located in upper and lower racks 130, 132, respectively. The arrangement of the discharge ports in at least lower spray-arm assembly 144 provides a rotational force by virtue of washing fluid flowing through the discharge ports. The resultant rotation of lower spray-arm assembly 144 provides coverage of dishes and other dishwasher contents with a washing spray. In various alternative embodiments, mid-level spray arm 148 and/or the upper spray arm are also rotatably mounted and configured to generate a swirling spray pattern above and below upper rack 130 when the fluid circulation assembly is activated and door assembly 120 is properly closed to seal wash chamber 106 for operation.

[0021] Figure 2 is an exploded perspective view of an exemplary dishwasher door assembly 120 that may be used, for example, with dishwasher 100 (shown in Figure 1). Door assembly 120 includes an outer door panel 160 and an inner door panel 162.

[0022] Inner door panel 162, in an exemplary embodiment, includes an opening 164 therethrough for a vent assembly (not shown) and an opening 166 therethrough for receiving a detergent dispenser (not shown). Inner door panel 162 is further contoured in a bottom region 168 for accommodating lower rack 132 (shown in Figure 1) of dishwasher 100 (shown in Figure 1). It is noted that exemplary inner door panel 162 and outer door panel 160 are intended for illustrative purposes only, and that the present invention may be used with differently configured inner and/or outer door panels within the scope of the present invention.

[0023] In an illustrative embodiment, Inner door panel 162 is attached to outer door panel 160 via attachment flanges 170 on an outer perimeter of inner door panel 162 that are fastened to attachment flanges 172 in outer door panel 160. In one embodiment, an appliance control module (not shown) and a latch assembly (not shown) are further accommodated into door assembly 120 as those in the art will appreciate.

[0024] Figure 3 is a rear plan view of an inner door panel assembly 190 (the inverse of inner door panel 162 as illustrated in Figure 2). Inner door panel assembly 190

includes inner door panel 162 and a seal member 192 attached thereto at a bottom end 194 thereof. In an exemplary embodiment, seal member 192 includes an elongated head portion 196 attached to inner door 162 as explained further below, and a flap portion 198 depending from head portion 196 to prevent splash out of washing fluid at a bottom of door assembly 120. Flap portion 198 extends substantially an entire width of inner door panel 162 between inner door panel lateral sides 200, 202, and includes tapers 204 at each lateral end to facilitate pivoting of door assembly 190 about its lower end when door assembly 190 is attached to a dishwasher, such as dishwasher 100 (shown in Figure 1).

[0025] Seal member 192 is integrally formed in one embodiment and fabricated from known materials, such as for, example, double durometer rubber, according to methods and techniques familiar to those in the art to form a durable seal for a bottom of inner door panel 162. In alternative embodiments, seal member 192 is fabricated from other suitable materials capable of withstanding a dishwasher environment and being sufficiently rigid for handling to ease installation of sealing member to inner door bottom 168.

[0026] Figure 4 is a cross sectional view of a portion of inner door panel 162 along line A-A of Figure 3 with seal member 192 (shown in Figure 3) removed. Specifically, a bottom portion 220 of inner door panel 162 is illustrated, and bottom portion 220 includes a formation 222 shaped to firmly maintain seal member 192 (shown in Figure 3) in place despite opening and closing of door assembly 190, and also while simplifying installation of sealing member 192 (shown in Figure 3) to inner door panel 162.

[0027] In an illustrative embodiment, formation 222 includes a boot-shaped portion 224 depending from inner door panel 162 and extending downwardly therefrom. Boot portion 224 includes a neck 226, a substantially flat rear edge 228 partially defined by neck 226, an extended heel portion 230 depending downwardly from flat rear edge 228, and a curved arch portion 232 extending to a toe portion 234. Boot portion 224, as will be seen below, is shaped to engage and retain sealing member 192 while avoiding manufacturing and assembly difficulties of known door assemblies. A barrier portion 236 also extends downwardly from inner door panel 162 in a substantially

parallel alignment with a rear edge 228 of boot portion 224. Barrier portion 236 extends for a greater length than boot portion 224 and is in a spaced relationship with boot portion 224. In one embodiment, inner door panel 162 is integrally formed, including boot portion 224, from known materials, such as an injection molded plastic, although in alternative embodiments it is contemplated that other materials may likewise be utilized according to known methods and techniques to fabricate inner door panel 162.

[0028] Figure 5 is a cross sectional view of a portion of seal member 192 taken along line A-A of Figure 3 and removed from bottom portion 220 (shown in Figure 4) of inner door panel 162 (shown in Figures 2-4).

[0029] Seal member head portion 196 includes an opening 250 generally complementary in shape to boot portion 224 (shown in Figure 4) of inner door panel bottom portion 220. As such, seal member head opening 250 includes a heel portion 252, an arch portion 254, a toe portion 256, and a neck portion 258 for receiving respective portions of inner door panel boot portion 224 (shown in Figure 4). Seal member flap portion 198 extends from head portion 230 to a curl 260 at a distal end thereof.

[0030] Figure 6 is a cross sectional view of door assembly 190 (shown in Figure 3) along line A-A and illustrating inner door panel boot portion 224 received in seal member head opening 250. As such, seal member 192 is securely fastened to inner door panel, and unintentional separation of seal member 192 from panel boot portion 224 is substantially eliminated by boot heel portion 230 and boot toe portion 234 that resist positive and negative forces (i.e., forces to the right and to the left in Figure 6) generated in flap portion 198 as dishwasher door assembly 190 is opened and closed as dishwasher 100 (shown in Figure 1) is used.

[0031] Further, and unlike known bottom door seals, seal member 192 is relatively easy to install with slide on action. Seal member head portion 196 is inserted over inner door panel boot portion 224, and seal member 192 may be slid across a length of boot heel portion 224 until seal member 192 is completely attached to inner door panel 162 (as shown in Figure 3). Thus, depending upon installation preference and orientation of inner door panel 162, seal member 192 may be securely attached to inner door panel 162 with a left to right motion, a right to left motion, a bottom to top

motion, a top to bottom motion, or other motion to slidably attach seal member 192 to inner door panel 162. Sliding attachment allows quick installation with reduced effort relative to conventional press fit bottom seals, thereby saving assembly time and associated assembly costs.

[0032] Figure 7 is a cross sectional schematic view of a portion of dishwasher 100 (shown in Figure 1) with inner door panel assembly 190 attached thereto. Seal member 192 is attached to inner door panel bottom portion 220 via boot portion 224 and seal member head portion 196. Flap portion 198 extends beneath door panel barrier portion 236 and contacts an interior surface of dishwasher 100, such as sump portion 142 in an exemplary embodiment. Flap member curl 260 seats on dishwasher interior surface 142, preventing water seepage under flap portion 198 to an exterior of dishwasher 10. Flap member 198 further forms a seal in conjunction with door panel barrier portion 236, thereby sealing dishwashing fluid splashed on a top surface 262 of seal member flap portion 198 from seeping to an exterior portion of dishwasher 100.

[0033] An effective bottom door seal 192 for a dishwasher, such as dishwasher 100, is therefore provided with simplified installation and reduced assembly costs.

[0034] While the invention has been described in terms of various specific embodiments, those skilled in the art will recognize that the invention can be practiced with modification within the spirit and scope of the claims.